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DEVICE FOR CONTINUOUS HYDROPNEUMATIC CONVEYANCE OF POWDER-LIKE MATERIAL

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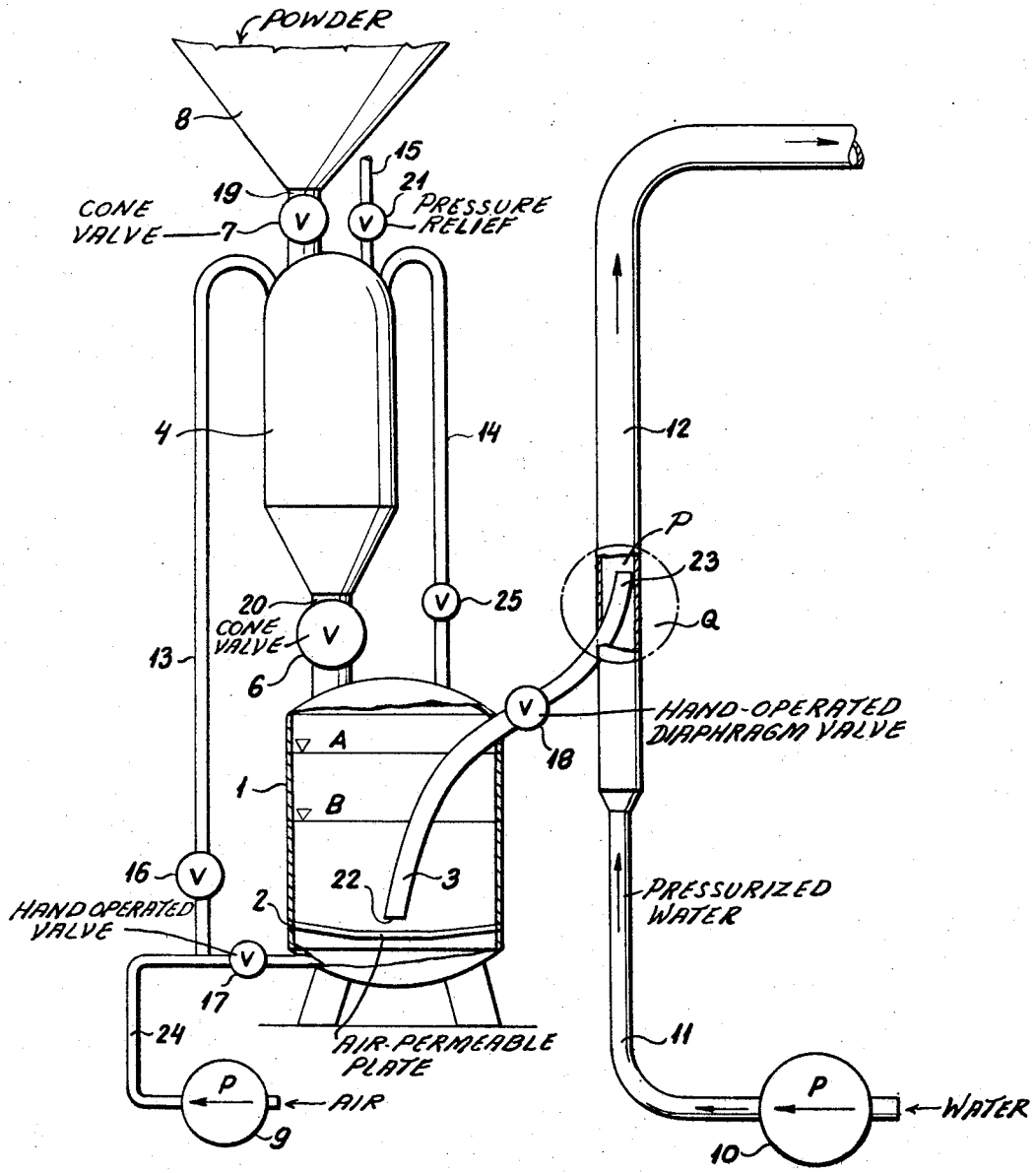

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DEVICE FOR CONTINUOUS HYDROPNEUMATIC CONVEYANCE OF POWDER-LIKE MATERIAL

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ABSTRACT OF THE DISCLOSURE

Method and device for the conveyance of a powder-like material over long distances in which the powder is entrained by air into an upwardly moving stream of liquid from a tank in which the powdered material is fluidized from a pressurized-air stream introduced to the tank from below which the power is supplied from above, the compressed air being at a pressure upon entraining the powder at least equal to the pressure in the liquid line.

The invention relates to a device for the continuous hydropneumatic conveyance of a powder-like or comminuted material which comprises a container with a powder inlet and a duct for compressed air.

Different devices are known for conveying powder-like materials, a common disadvantage of which is that large quantities of power and water are required. Also the procedure is generally discontinuous.

The invention resides in a device for the continuous hydropneumatic conveyance of a powder-like material, the device comprising a container having an inlet duct for compressed air, a charging tank connected to the container via a valve-controlled powder inlet, a valve-controlled outlet pipe leading from the container to a pipe line, the inlet duct being connected to the charging tank by a valve-controlled connecting pipe and the charging tank being connected to the container by a valve-controlled compensating pipe such that when compressed air enters the container via the inlet duct and the connecting-pipe valve, the compensating pipe valve and the powder-inlet valve are closed, a mixture of powder and air flows through the outlet pipe into the pipe line, and when the connecting-pipe valve, the compensating-pipe valve and powder-inlet valve are open powder passes from the charging tank to the storage tank whereby a continuous stream of air and powder passes from the container to the pipe line.

Preferably, the charging tank is provided with a valve-controlled blow-off pipe.

Conveniently, the storage tank is connected by a valve-controlled inlet to the charging tank.

According to another feature of the invention, the container is provided with an air-permeable plate arranged near one end of the outlet pipe and dividing the container into two parts, the inlet duct leading into one part, and the outlet pipe leading from the other part such that compressed air entering via the inlet duct passes through the plate before entering the outlet pipe.

Advantageously, the valve of the outlet pipe is a hand-operated diaphragm valve and the powder-inlet valve is a cone valve; the pipe line may be connected to a water pump via a pressurized-water duct.

With the equipment according to the invention the powder-like material can be continuously conveyed through large distances with lower water and power requirements than hitherto. The concentration of the powder remains constant in the pipe line while the pressure in the container is also constant so that no water can flow back into the pneumatic part of the equipment from the hydraulic part.

The invention will be further described with reference to an embodiment thereof shown in the accompanying drawing the sole figure of which is an elevational view, partly in vertical cross-section.

The device comprises a closed pressure-tight container **1** having a compressed-air inlet duct **24** opening into the bottom part of the container and connected to an air compressor **9**. A hand-operated valve **17** is arranged in the air inlet duct **24**. A charging tank **4** is coupled to a powder inlet **20** on the upper part of the container **1**. The charging tank **4** is connected to a storage tank **8** by a duct **19**. A cone valve **6** is arranged in the duct **20**, and a cone valve **7** is arranged in the duct **19**. The valves **6** and **7** are controlled automatically. The charging tank **4** is connected to the compressed air duct **24** via a connecting pipe **13**, and is also connected to the container **1** via a compensating pipe **14**. Valves **16** and **25** are arranged in pipes **13** and **14**, respectively. A blow-off pipe **15** having an automatic valve **21** is provided on the upper part of the charging tank **4**.

In the bottom part of the container **1**, a plate **2** is provided which is permeable to air. One end **22** of a duct **3** leading into the container **1** is adjacent the plate **2** and, the other end **23** of the duct leads into an upright pipeline **12**. Pipe line **12** is connected to a water pump **10** via a pressurized water duct **11**. A hand-operated diaphragm valve **18** is mounted in the pipe **3**.

The device operates as follows:

The container **1** is filled with powder up to a level designated A. Water pump **10** is turned on and water flows through the pressurized water duct **11** into the pipeline **12**. The air compressor **9** is also turned on and the valve **17** in the compressed-air inlet duct **24** is opened by hand. Since the cone valve **6** and the diaphgram valve **18** are closed, the container **1** is filled with air. The air passing through the plate **2** becomes mixed with the powder in the container **1**. Meanwhile the cone valve **7** of the charging tank **4** is open and the tank **4** is filled with powder through the inlet **19** from the storage tank **8**. The valve **16** and **25** in the ducts **13** and **14**, respectively, are closed and the valve **21** in the blow-off duct **15** is open.

When the pressure of the powder-air mixture in the container **1** is equal to or greater than the pressure at the point P of the pipeline **12** the hand-operated valve **18** is opened and the powder-air mixture flows from the container **1** into the pipeline **12**. Subsequently valves **17** and **18** remain open.

When the level of the powder in the container **1** sinks below level B, the cone valve **7** and valve **21** close, while valve **16** in the connecting pipe **13** opens. The pressure in the container **1** and charging tank **4** become equal. When valve **16** and **25** are opened, the powder flows from the charging tank **4** into the container **1** and fills the latter up to the level A. The procedure continues and a continuous conveyance is achieved.

The procedure is started by a level indicator. All the valves are automatically controlled except valves **17**, **18** which are hand-operated.

I claim:

1. A method of continuously conveying a powdered material through a pipeline, comprising the steps of:

continuously passing a stream of pressurized liquid generally upwardly and thence into said pipeline;

temporarily retaining a portion of the powdered material in a charging tank;

entertaining powdered material in a pressurizable fluidizing container with air introduced into said container from below at an elevated pressure; and ap-

plying pressure to said charging tank prior to the release of powdered material from said charging tank into said container and upon the quantity of said powdered material in said container falling below a predetermined value, and then connecting said charging tank with said container for supplying powdered material from said charging tank to said container, while continuously entraining powdered material from said container into the stream of liquid in an upward direction.

2. A device for continuously conveying a powdered material comprising, in combination with a pipeline, an upwardly extending pressurized-liquid pipe conducting a stream of pressurized-liquid pipe conducting a stream of pressurized liquid into said pipeline; a pressurizable fluidizing container adapted to receive successive quantities of powdered material; first duct means communicating between said container and said pipe and having an outlet end opening upwardly into said pipe and said stream of liquid; compressor means connected with said container for directing a stream of air generally upwardly into said container to fluidize continuously the powdered material therein while continuously entraining said powdered material through said first duct means into said stream of liquid, said compressor means maintaining said container continuously at a pressure at least equal to the liquid pressure in said pipe at said end of said first duct means; a pressurizable charging tank adapted to receive a quantity of said powdered material; second duct means connecting said charging tank with said container and provided with a valve; and third duct means connected with said charging tank and intermittently operable conjointly with said valve upon the quantity of said powdered material in said container falling below a predetermined value for applying pressure to said charging tank at least equal to the pressure in said container and then opening said valve to release powdered material from said charging tank into said container.

3. A device as defined in claim 2 wherein said container is provided with an air-permeable plate, said compressor means being connected with said container below said air-permeable plate and having a manually operable valve controllable to adjust the flow of air into said container and through said plate, said third duct means forming a pressure-compensating duct connecting said container above said plate with said charging tank, said device further comprising another duct having a valve connecting said compressor means with said charging tank, said charging tank being further provided with a pressure-release valve, a hopper for delivering powdered material to said charging tank and a valve between said hopper and said charging tank, said first duct means having a manually operable valve for controlling the flow of air-entrained powdered material into said stream of liquid, said pressurised-liquid pipe being connected with a water pump.

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